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KaleidoSCOPE, under Title III, Elementary and Secondary Education Act, disseminates articles dealing with current topics and trends in education of particular interest to educators. This edition is the result of a series of programs dealing with learning and the underachiever. Dealing with the definition of the underachiever was John Holt, speaking on "How Children Fail." A paper, entitled "The Nature of Cognitive Growth," discusses the Bruner and Piaget theories of development as they are related to learning and modern education, with emphasis on the underachiever in Math. Papers were delivered on "Project Bridge" (Building Resources of Instruction for Disadvantaged Groups in Education), and "Types of Research Being Carried on in the Field of Low Achiever in Mathematics." (KP)

# KALEIDOSCOPE

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**SCOPE**

*A Cooperative Effort Serving Suffolk Education*

# KALEIDOSCOPE

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LEARNING

AND

ACHIEVEMENT

VOL. I, NO.2

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SCOPE

*A Cooperative Effort Serving Suffolk Education*

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Prior to 1965, the individual districts of the county were restricted in their approach to the problem of the underachiever to the resources and talents within their boundaries and budgetary limitations. However, since Commissioner Allen's ruling on the underachiever in 1965, New York State and particularly Suffolk County has moved forward on a cooperative basis in this area of national concern. The committment to "quality education" for all the children of Suffolk County stimulated SCOPE to seek out a number of districts confronted with the common dilemma of the underachiever. By pooling our resources and talents we hope to alleviate some of the problems related to underachievement.

With the above ideas in mind, the SCOPE Executive Committee approved a series of programs on learning and the underachiever. In October 1966, SCOPE launched the first phase of its underachiever program, dealing with the definition of the underachiever. John Holt, the author of "Children Who Fail" was a speaker at this program. In April 1967, the second phase devoted to theories of learning, Dr. Vera John presented a paper entitled "The Nature of Cognitive Growth". Her talk explained the Bruner and Piaget theories of development as they are related to learning and modern education. The most recent phase of this program was conducted as a cooperative project under Title I ESEA, in conjunction with the New York State Education Department. Emphasis was placed upon the "Underachiever in Math". Mrs. Natalie Mintz delivered a paper on "Project Bridge" and Dr. Beryle E. Hunte made a presentation on the "Type of Reserach Studies Being Carried on in the Field of Low Achievement in Mathematics". Each of the three programs conducted by SCOPE had at least three known authorities in the field of learning or underachievement. We believe the materials presented in this edition of KaleidoSCOPE will be of particular interest to those teachers and administrators who were unable to take part in the programs.

Although we understand the individual problems of the underachiever cannot be solved through the dissemination of this publication, we do hope this edition of KaleidoSCOPE will provide additional insight into some of the needs of the underachiever.

The original tapes from which these talks were taken are available (on a loan basis) to the districts of Suffolk.

KaleidoSCOPE is a new vehicle for dissemination to Suffolk educators, it will attempt to keep the educators of the county "in touch" with current topics and trends in the field of education. Future editions of KaleidoSCOPE will contain articles on technology in education, foreign studies in the curriculum and other topics of interest.

William H. Heath
Executive Secretary, SCOPE

# "HOW CHILDREN FAIL"

## BY JOHN HOLT

Let me begin by quoting a couple of what may seem an oddly mixed pair. One is Alexander Hamilton, the other is Robert McNamara.

In one of the Federalist papers, Hamilton is saying or writing to people, that he thinks a federal union of the 13 colonies is desirable and necessary. He begins by saying that he's not going to mince words. He's convinced that this is the right thing to do. Two sentences that have stuck in my mind, and I quote, "I affect not reservations that I do not hold. I will not amuse you with the pretense of deliberation when I have decided." Now when I think of rather phony, so-called objective and impartial language in which a great deal of academic talking and writing is done I always think of Hamilton. I'm going to try to say as simply and bluntly as possible what I think rather than dress it up very much. I say it in the hopes it will be useful; if it makes some people angry I will be sorry, but I'm going to say it anyway. Now as for Robert McNamara, when he was president of Ford Motor Co., he used to do a lot of skiing in Aspen and when he did, he often skiied with my brother-in-law who is an instructor there. As they rode the lifts they'd discuss many things. One day my brother-in-law said to him, "When you took over Ford, was there any one problem that really stood out as being more difficult and more important than any other?" McNamara said "yes, as a matter of fact, there was. There was one problem which was incomparably greater than any of the others. To find out what was going on". My brother-in-law said "What do you mean?" McNamara said "Well the trouble is when you're the head of an organization everybody tells you what they think you want to hear". Now I mention this to you because I suspect this is probably a problem of yours, to some degree, as heads of educational organizations. You're in the general staff department rather than the front line troops department, and it really is not easy for people who are running schools or school systems to find out what it's like down at the bottom. This is something I think I can perhaps tell you something about. I'm very keenly aware that most of you, in the day-to-day conduction of your work, have to deal with a lot of very difficult problems that I have no experience with or knowledge about. On the other hand, if I do speak it's because I think there may be problems that I know more about or that I've seen from a different angle than you have. I don't know if any of you have ever read any of Don Marquis' poem about Archie and the Cockroach. Just out of curiosity, have you? "The lives and times of Archie and Mehitabel". Oh, I recommend it to all of you. I think you should have it in the school library. I always found it a great favorite among students. But one of Archie's poems is a ballad called "I See Things From the Underside". Well as a classroom teacher, I see things from the underside and my book is about school from the underside, school as it looks to children. If I'm an expert about anything, it's about school as it looks to children, not really curriculum. I do think I know more than the average bear, let's say, about how children feel about school. And how they act there and when they're failing, why they're failing. The most important cause of failure in school is fear. I state that bluntly as I can. A very great part of the job of reducing failure in school is the job of reducing fear. And it seems to me that this responsibility falls very heavily on you as educational leaders. If children are anxious and fearful as they are in most classrooms a very considerable reason is that most teachers are anxious and fearful. I have been in quite a lot of classrooms, some as a student, many as a visitor. I know people in whom I have really great confidence, who visited in schools much more widely than I have. I have talked to many roomfuls of teachers and people who've been closely associated with teachers for a long time; and I think I can say, without much fear of being

wrong, that while there are exceptions, exceptional teachers, perhaps exceptional schools, by and large most teachers are pretty anxious about their work. The average teacher does his or her work in a pretty tense and nervous frame of mind. And this communicates itself to the children. This multiplies itself, by the very considerable fears and anxieties which children bring to the classroom. So if we're going to reduce the fears of children we have to reduce the fears of teachers. And if we're going to do that, a kind of educational leadership has got to be given which may be somewhat different from what we know as traditional. I've never been very sure in my own mind what the function of the head of a school, or the head of a school district was. I still don't know a great deal about it, but it does seem to me that one of the chief businesses of any leader of men, in any kind of work,has to do with morale and this matter of fear. I think I would say that it's a very important task of an educational leader or an administrator to inspire, support and protect his teachers.

I suspect it is generally assumed, by people who talk about failure in school and the problems of the underachiever and so forth, that an intelligent, emotionally healthy, well motivated, capable child will do well in school. This I think lies behind what a lot of us say and do. And one of the blunt things I'm going to say is that I doubt that this is true. Or I think I can conceive of a great many cases in which it would not be true. I can think of a great many reasons why an intelligent and capable child would do badly in school and not very many why he'd do well and the reasons are not particularly to his credit. I was a good student, and I can tell you precisely why I was a good student, because I was scared not to be. I wasn't interested in my classes or courses. I can count the small number of teachers and classes in which I had in a faily high-powered educational experience, that really interested me. But I was simply afraid of getting into trouble if I got bad marks. And I knew the tricks of getting good ones, so I got them. This doesn't seem to say much for my character. I don't look back on that with much pride and I have known some children, very intelligent and capable who had more courage than I did and who have quit, frankly and openly resisted school, because it was dull. You have to get into a classroom and think, not what it's like from the point of view of an administrator, not our program, not our curriculum, but think what would it be like to be 7 years old, 8 years old, 10 years old and 12, 14 and sitting here and having to sit here today, tomorrow and the next day and the next day and I'll tell you it's dull beyond belief. This is the world's most captive audience. I'm very critical of what goes on in most school classrooms. And I think we will make a mistake if we approach the problem of underachievement and failure in school by assuming that where we have failure and underachievement is because of some fault in the child. Maybe, there are plenty of emotionally-disturbed children and children who for one reason or another are not capable of working, but that's not the only reason. We ought not to think that it is.

I'm opposed to examinations and marks and I think the less of them we have the better. Now obviously you're not in a position to do away with them. Neither am I, I'm an English teacher, I have to give marks I don't like to, I have to. But I give them as seldom, as privately as I can and I make them as easy as the boss will let me get away with. We have arguments about this, and I compromise a little but no more than I think I have to. I don't think examinations help the learning process at all. I think they add considerably to the fear both of the students and of the teachers, I don't think they give us very useful information even when they don't add to the fear. And in any case I think they impede the

process of learning. Well, they impede it when they don't corrupt it. One of the open secrets of the education profession, the kind of thing that every teacher knows but not very many people say in public is that when you know you're going to be judged by tests you teach to the tests. Any teacher who has to give children standardized achievement tests spends a certain amount of time cramming them for it. And I as a 5th grade teacher met any number of children who had been crammed by their previous teachers into getting third, fourth, fifth grade equivalent scores on their arithemtic tests in spite of the fact that they couldn't add without using their fingers and sometimes not even then. While conversing with a SCOPE staff member he told me about a chemistry teacher that he'd had in school. At the beginning of the year he said to the class, "What do you want to do this year? Do you want to learn Chemistry or do you want to get a high mark on the Regents?" They said we want to get a high mark on the Regents. So that's what he spent his time doing. He had a Regents review book, he did only the laboratory experiments that he knew the Regents examiners were likely to cover, he spent most of the time on the questions that he thought they were likely to ask and let other things alone and they got high marks. I had an Ancient History teacher at Exeter where I went to school that could play the same game. He'd been on the History college board committee for years and even after he left the committee he had a way-back file of their examinations and he knew how their minds worked and he knew about how often the questions would come up in rotation. I remember him telling us to study fifteen questions and be ready to write 20 minutes on each of them. And he said you will be in no trouble. Well we studied the questions and sure enough, 8 of the questions on the college board exam that I took were so close to the questions that he'd given us, it was almost as if we'd had a preview of the exam. Now he hadn't cheated in the sense that he'd actaully seen a copy, no, but was it very different from that kind of cheating? I don't think so. I knew I didn't know much about ancient history, and most of what little I knew I'd forgotten in 3 months. I don't think - this is not really an honest business. I think this testing, and so forth really corrupts the learning process. And we've got to struggle and resist against it as much as we can. This is my conviction.

Homogeneous grouping, I'm opposed to it. I think it's a natural consequence in a falacious belief that in the interests of efficiency all the children in the class should be doing the same thing at the same time. If your concept or mental picture is a group of people going down a road, a path, a track, towards some kind of destination, if this is how we feel about it, well then we naturally think in terms of the slow ones holding up the fast ones. But if on the other hand if there is a room full of people doing very different things in very different ways then there's no question of somebody holding up somebody else. If I go to the Boston Public Library and sit down in a room and start to read a book, I am not held up by the fact that there are a hundred people in the room who may not be able to read a book as fast as I can. I once taught a fifth grade class in which the - in which the grade equivalent scores of my pupils of the Stanford Achievement Test results ranged from 3.1 to 9.0. That's a good spread isn't it? The girl with the 3.1 was 12 years old, she was already 2 years behind the class. I might have thought about teaching that class as a unit but necessity made me think in terms of individual learning. It was a very productive year for everybody in the class, slow and fast. One most significant thing that happened and this is something that schools are doing in many places for all I know, many of you may be doing. In many places, we're beginning to discover that children are better teachers of other children, than adults. And in quite a number of places

I've read of school systems where 5th graders are working with first or second graders, or eighth graders working with children 3 or 4 years younger than themselves. So I think we should do everything we can, not to divide up children according to abilities or ages; and let me say here that much of what I read about ungraded schools seems to me to be just a much more refined kind of homogeneous grouping if you see what I mean. So that little Johnny, who's a terrific math student is in the terrific math section, he's not such a good reader so he's in the not-so-hot reading section, and he's pretty punk at geography so he's in the punk geography section. This isn't what I mean by mixing up students. I mean that there should be a continual contact, as much contact as possible between students of all kinds of all ages, interests, and abilities. Because it's under these circumstances that they'll learn most from each other. I suppose you can call me a curriculum reformer, I'd like to do away with it altogether. I don't really believe in the idea that school ought to be a place where children are compelled, bribed, bullied, wheedled, seduced, tempted into learning a certain number of things that we've decided it will be good for them to learn. I think school should be a place where, a very substantial part of the time, and I'm thinking in terms of 80% or more, children learn the things that their curiosity most impels them to learn. I think it ought to be a place for exploration, I think in other words, that children should have as much control and direction as possible over their own learning. Now could I write an entirely new dissertation about why I think this is true and what consequences flow from it, but I'm not going to. I'll just say that I think we should do everything we can to make more flexible, make less rigid the curriculum to allow children to explore the unknown territory of the world in as many different ways as possible.

**MR. JOHN HOLT** attended Exeter and Yale. After receiving a B.S. in Industrial Administration in 1943, he joined the Navy and served in submarines during World War II. After the war, Mr. Holt worked for six years with the World Federalists. He began teaching at a college preparatory school in 1953. He has taught secondary English, French, mathematics and also the fifth grade. Mr. Holt has done curriculum development work in mathematics and reading. He is presently teaching ninth and eleventh grade English at the Commonwealth School in Boston, Massachusetts, a college preparatory school.

Mr. Holt is author of the best seller HOW CHILDREN FAIL, of which Book Week said " . . . most original and interesting . . . Holt's empathy for the child's mind is extraordinary . . ." The New York Review of Books put Mr. Holt in a class with Piaget.

# "BRIDGE" (BUILDING RESOURCES OF INSTRUCTION FOR DISADVANTAGED GROUPS IN EDUCATION)

BY NATALIE MINTZ

BRIDGE, (Building Resources of Instruction for Disadvantaged Groups in Education) was to find ways of effectively preparing all teachers to work in culturally deprived neighborhoods. The problem was twofold:

1. How to bridge the gap between essentially middle class oriented teachers and the lower class youth of varied ethnic backgrounds present in public high schools and,
2. How to modify the college curricula so as to meet the future teachers' needs and prepare the teachers for the unique problems of classroom instruction at the grass roots level in the low achievement schools.

In essence, the physical makeup of BRIDGE was three young teachers each having no more than three years teaching experience, a seasoned curriculum master teacher, supervisor, confidant, coach, critic and resource person, a psychologist for testing only, and a part time school guidance counselor, a Queens College committee of four professors and inexhaustible pool of resource consultants drawn from Queens College. Our pupils numbered 90 at the beginning of the 7th year, and remained with us for three years (grades 7-9) subject to attrition.

Class size: Since our original pupils were randomly selected we had to take new entrants when any of the original 90 were dropped. We did this, with several things in mind. The top class scholastically stayed 30-33, the next class referred to as the 2 class usually had 27-30, and the 3 class by decision of the staff stayed at 25 or fewer when possible. The grade counselor was aware of the project, and therefore she was very helpful. All children were given a reading test (oral) when they entered her office, and this was one of the ways she placed the children in the correct class. When working with educationally disadvantaged children it is wise to keep the classes as stable as possible. The less shifting and changing that takes place the easier for the teacher to work in his or her subject area. If there are many new entrants, and extra teachers are available it would be better to form a new class even with a register as low as 18.

## Math and the BRIDGE Project

We were involved in the everyday duties of all teachers. The unique aspects of our work in math was the everyday curriculum planning aimed at meeting the group needs of the children. (These children were retarded in reading on the average of 2.2 years, with a range of grades on the Metropolitan Achievement Tests from 3.0-10.0. Seven out of eight pupils were below reading at the onset of the project.

Throughout our work in this laboratory classroom we sought appropriate approaches to the teaching of mathematics. Planning was not a one day seminar, or a one week workshop but an everyday item on my agenda. With the help of our master teacher-supervisor, we planned specific activities (e.g. use of Dienes balance), tried new concrete approaches to everyday math (e.g. use of Gertz catalog for teaching per cent), and worked out appropriate materials as the needs became apparent (teacher made ditto sheets). The official math texts were rarely used...semi-original and original teacher materials were given to students daily and combined by the students to form their own personal textbooks. (Each teacher ordered texts as we discovered the needs of the three very different classes.)

Evaluation of what took place in the classroom was done almost immediately and remedies where necessary could go into effect often at once. The advantage being that teaching in a fish bowl as we were, enabled us to get immediate feedback. We were able to see the units of work take shape, and we could then observe the results and plan accordingly.

In all subject areas, the needs of the children dictated. We discovered that it was difficult to teach any new units of working without running into the problems of "how to take away" or "times". The old method of drill just didn't work (we tried it). Then we hit upon an interesting idea. We found that if we could create a desire or a need to learn a more difficult concept the basic computations needed for figuring out the answers became easy to teach. A simple unit on algebra was a real success. The word algebra has magic for the slower pupils because they never get to take it - "it's for better kids". The children in my class burned up the tables trying to learn how to multiply 9's and 8's and divide fractions. Often we were able to accomplish the skill aspect of the math with individual folders. Each person took a diagnostic test which pointed up his weaknesses to the student and the teacher only. Then a series of sheets was prepared for the students in each weak area. The student worked on this skill until he felt himself ready for the test. Marks were completely deemphasized in any area of skill work. We had a great deal of success with this aspect of our work. This was also a way of helping the students learn responsibility. They handled the file folders, the skill work and the tests, and many times each student would be working on a different skill, the class was completely on their own. A very enlightening experience for pupils and teachers.

The needs of the children pointed the way to consumer mathematics. The entire area of installment buying, money lending, bank loans was explored. And where possible we invited people from the community to talk to the students. We had insurance men, bank clerks, and detectives talk about their experience with our consumer math.

We discovered in our unit on graphs, maps and scales that our children had almost no concept of distance. The distance from New York City to Philadelphia ranged from 30 miles to 3000. Few of the students could judge distances that they traveled to school from their homes. And many we discovered, rarely ventured forth from their own neighborhoods to explore other areas of the city. So how could the social studies teacher expect them to know about the span of miles between here and Africa or where and how far away were their brothers in Viet Nam? Many activities for teaching map reading and scale drawings were planned on the basis of our new discoveries.

Reading and Mathematics

Since the majority of the children were two or three years behind in reading, the teachers in all the subject areas were obliged to teach reading. We learned how to do this on the job. We needed the skills immediately. The generalities we learned were soon translated into the classroom in mathematics. Vocabulary in math was developed where possible with words children had seen and learned before (e.g. fraction and fracture; per-cent and cent; equal and equality). Understanding what were once insolvable problems were built through the teachers' knowledge of context clues and comprehension skills.

The College

While the teachers and pupils were learning, the college staff was active. There was always one of our professors working with a group of youngsters or observing a lesson in session. The professors liked the laboratory atmosphere, and were observing at first hand, what works and what doesn't. Regular conferences in each area included the appropriate college teacher. Through this type of conference and observation and participation the professors changed and exchanged ideas and their curriculum and course content at Queens College changed.

Summary:

There are many aspects of any project that cannot be evaluated with tests. The ideas and convictions shared by colleagues after a particularly disastrous day can be very revealing.

All of us on the BRIDGE Project knew from our three year experience the joys and the pains involved with the work in the slum-ghetto school. We also knew that ideally the novice did not belong on the firing line that first year. A time to adjust was needed, a time to "learn the administrative ropes", and a time to get the feeling of what it is like to teach to an audience motivated to learn was needed. We also knew that the stark reality of the situation was the demanding need for teachers in the ghetto areas. And, the fact that most newly appointed teachers in (New York City) found themselves in the most difficult schools upon graduation from college.

With this knowledge, and the strength of our convictions in the BRIDGE Project we offer two things. The first, a fifth year for the fledgling. A year in which to become a strong confident teacher. A year in which to build a materials file, unit plans, diagnostic tests, and skill sheets. A year in which being alone in the classroom is non-existent. A year with skilled help, as I described on the BRIDGE Project. A year to sit down and talk about the very difficult all consuming teaching problems present in the classroom. A year to do some creating and a little experimenting. A year to understand the children and their needs. No pre-service or inservice training in college or outside can provide the experience this fifth year will provide. A full teaching program for the new teacher is impossible in the beginning. We must give this teacher a chance to know success.

The second thing we offer, are many BRIDGE Projects all over the country in areas comparable to Jamaica, Bedford-Stuyvesant and Harlem, New York City ghetto communities. We need to begin to spread the fruits of our work to other areas. We need many classroom laboratories with teachers who are willing to try and experiment. The interesting thing is that what I have described doesn't require Ford Foundation to empty its pockets. BRIDGE type projects can be worked into the school budgets with the money already there. Our children can't wait. We need to act now.

**MRS. NATALIE MINTZ** is a teacher of mathematics and science in the New York City Public Schools. She holds an M.S. degree. Mrs. Mintz was on the school project staff of the BRIDGE project, 1961-64, as a mathematics and science teacher. The project was sponsored by Queens College, The City University of New York, for the preparation of teachers to work with underachievers. She was a consultant to the National Education Association's conference on disadvantaged youth, April 1965, and instructor at the Queens College summer institute for teachers of disadvantaged youth, 1966.

# "TYPES OF RESEARCH STUDIES BEING CARRIED ON IN THE FIELD OF LOW ACHIEVER IN MATHEMATICS"

BY BERYL E. HUNTE

The Elementary and Secondary Education Act of 1965 defines the "educationally deprived child" as one whose educational achievement is below normal expectancy for his age and grade and who lives in poor social and economic conditions. The term also includes those children who are handicapped because of physical, mental, or emotional impairment. ESEA also recognizes that "environmental conditions and inadequate educational programs rather than lack of mental aptitude carry the major responsibility for the later failure of these children to perfom adequately in the school system."

We know, then, who these children are and we know that they are found mostly in the slums of cities, certain rural areas, migrant labor camps, and Indian reservations; and we know that the consequences of such environments are the school dropout, delinquency, mental retardation, and educational retardation.

It is within this framework and with these basic assumptions that most of the sparse existing research has been conducted. The types of research generally fall into these categories:

1. Curriculum experimentation at every grade level
2. The effect of the environment on mathematical learning, especially in the kindergarten and primary grades
3. The effect of remediation programs

## Research Studies

### 1. Curriculum Experimentation

On the basis of one of the recommendations made at the S.M.S.G. Conference in April, 1964, S.M.S.G. is attempting to gather information helpful in the development of a mathematics program for disadvantaged children in the elementary grades. Experienced teachers in six major cities are using S.M.S.G. kindergarten and first grade books with children from deprived areas. Additional classroom materials as well as consultants are supplied by S.M.S.G. I shall now describe their first attempt at research in the area of curriculum materials. Then I shall proceed to discuss other research studies.

An inventory was constructed to determine the level of children's pre-school experience in certain clearly defined areas. Two classes in a disadvantaged area where the schools are not receiving the additional materials and consultants mentioned above were selected. Classes in middle-class areas of two cities were used as controls. The inventory consisted of a series of tasks taking approximately thirty minutes. (Explicit directions were prepared and pretested on a group of five and six year olds in the Oakland, California area). Early in the school year assessments of the following dimensions were made:

1. Ability to recognize objects and pictorial representations of objects to be used in the curriculum materials
2. Ability to match two sets of color cards, to name a given set of colors, and to identify a color when it is indicated by name
3. Ability to recall an object after it has been removed from a given set
4. Abilities relating to number (five parts)

a. Ability to select a given number of buttons from a heap - 3, 5, 4, 6, 8, 7, 9
b. Ability to mark number symbols - 0, 1, 3, 4, 5, 7, 8, 9
c. Ability to recognize number symbols
d. Rote counting ability
e. Concept of ordinal number

It was found that the achievement of pupils in the experimental classes was generally below that of the control classes on the tasks tested. These differences were greater in the first grade than in kindergarten. More specifically, the majority of pupils in the control classes could do all seven tasks of counting buttons correctly; only about half in the experimental classes could. In the first grade control classes, all the pupils could name each of the number symbols whereas many of the first grade experimental classes were unable to name all of the symbols and a significant number could not name any.

The results of the inventory show that many first grade children from deprived areas are below the mean achievement level for middle-class kindergarten children, while others in the same classroom are achieving as well as middle-class first graders. It is the opinion of S.M.S.G. that students from deprived backgrounds are not initially prepared to learn mathematics at the same pace as middle-class children and many have not reached the same level of cognitive development.

Kenneth Easterday reported the following study in the Mathematics Teacher of November, 1964. Its aim was to determine if "modern" mathematics could be taught effectively to low achievers. Also could the reasoning and/or fundamentals of low achievers in the junior high school be significantly increased? Thirty-seven 8th graders with median IQ of 100 and forty-one 7th graders with median IQ of 94.1, age 11-15, were used for the study. With overlapping considered, 25 of the 8th graders and 20 of the 7th graders had a history of academic difficulty, discipline problems, and/or psychological problems prior to entering the program. The California Achievement Test, Form X was given at the start of the school year.

"Traditional" mathematics was used to strengthen the fundamentals or computation; "modern" mathematics was used to strengthen both the reasoning and fundamentals. This material was adapted from the material prepared by the S.M.S.G. for the elementary school - EM 101-107. Concepts were introduced through techniques suggested by S.M.S.G. and additional practice was provided by "traditional" worksheets. Both grades started at uppper 4th grade level. As individual children reached a level where they could not function, they were removed from the class and formed into small groups for added instruction. A test was given after each topic. If the child was successful he was moved on the next step; if not, he repeated the process until the teacher felt that no positive results could be had with additional time. Levels of expectation were adjusted. If the child had difficulty reading, the material was read to him independently. The movement within groups in the classroom and entering or leaving the program was fluid. At the end of the school year the California Achievement Test Form W was administered.

It was found that there was growth in mathematics reasoning and fundamentals. The entire sample had a median composite increment of 1.25 years and there were individual increases of up to three or four years.

2. The Effect of Environment and Mathematical Learning

What effect do differences in socio-economic background have on kindergarteners' arithmetic concepts? To answer this question, four kindergarten classes of 82 pupils, 51 from a low socio-economic section and 31 from a high socio-economic section in the San Francisco Bay area were chosen. The children were given the Arithmetic Concepts Inventory for Kindergarten and Entering First Grade which consists of five sections - enumeration, quantitative relationships, symbol recognition, social usage, and problem solving. No IQ tests were given because it was felt that no test existed which could possibly give an accurate measurement for these children. The results indicated a significant difference in the mean scores. For the low socio-economic it was 15.35 and for the high socio-economic it was 24.16.

Another study in this category posed the complex problem: To ascertain the nature and extent of achievement of pupils who are entering kindergarten with respect to selected mathematical concepts, skills, and abilities as described by test items requiring mathematical insights and/or skills and abilities; to discover the levels of achievement of various groups when categorized by selected psychological and sociological factors; to ascertain by the correlation method the extent of relationship that exists between the test of mathematical achievement and various psychological and sociological factors; to discover some of the circumstances and conditions existing in the home which apparently influence some kindergarten entrants to attain a high level of mathematical achievement while others of equal mental ability fail to realize proportionate accomplishment. Five hundred ninety-five kindergarten entrants from six elementary school districts in Southern California located in the greater metropolitan area of the city of Los Angeles were chosen. The various tests were administered to children present in 9 classrooms and on a random basis to children in 7 classes. The mean IQ for the 301 boys was 101.45 and for the 295 girls 106.02 for the group 103.71. It was found that there is a definite but small relationship between socio-economic status and mathematical achievement. The extent and nature of mathematical achievement of kindergarten entrants are far-ranging and are associated with a number of factors.

3. The Effect of Remediation Programs

The following two studies are important, I believe, because they attempt to show what can be done for the educationally disadvantaged child.

The Youth Development Center at Syracuse University in collaboration with the Arithmetic Studies Center at the University conducted a survey of the extent of underachievement in arithemetic at the 8th grade level in a junior high school situated in a depressed area of an eastern city. (The student body of the school is drawn from the lower socio-economic section of the city and over 70% of the population within the age range, 0 - 19, is nonwhite)

The 8th grade population of the school was divided into four IQ subgroups within the range of IQ scores. The mean IQ for the entire group was 90. Children above the mean IQ of the group were generally underachieving while those below the mean were generally over-achieving. The under-achievement was greatest in the

upper extremes of the IQ range. The top 15% of the 8th grade group averaged 20 months under-achievement with some children under-achieving by as much as 55 months. On the achievement test norms, these brighter children were generally achieving below the 30th percentile. Hence the experimental program was conducted at the school for the following purposes:

1. To try to get a more detailed picture of the nature of the under-achievement in arithmetic at an eigth grade level in a school situated in a deprived area
2. To ascertain if individual diagnostic and remedial treatment procedures being used at the Arithmetic Studies Center could reduce significantly the amount of under-achievement of an experimental group as measured by a standardized achievement test.

Twenty pupils with high discrepancy between their mental age and their arithmetic-achievement age were chosen from the 8th grade population of this school. They were given the California Arithmetic Test, Form W, as a pretest. They were then divided into two groups of ten, each composed of 6 boys and 4 girls. One was classified as the experimental group, the other as the control group.

| | Mean Age | Mean IQ | Mean months of under-achievement |
|---|---|---|---|
| E | 13.4 | 108 | 18 |
| C | 13.8 | 102 | 18 |

Each child in the E group was interviewed individually by the researcher. After initial interview and scrutiny of the California tests, some of the children seemed to indicate that they had common difficulties and were grouped together. The program proceeded with one group of 3, two groups of 2, and three people meeting individually. During the three-month duration of the program, there were generally 8 to 9 meetings of 45 minutes duration held with the experimental group.

Although various students required different types of help, much of the time was spent on base 10 notational system, part-whole idea of addition, and subtraction as the inverse of addition, factor-factor-product idea in multiplication, and division as the inverse of multiplication, and arithmetic terms. The final two or three meetings were spent on improving computational skills; Brueckner's "Diagnostic Tests and Self-Helps in Arithmetic" were used for this purpose. No extra work was done with the control group during this period. Both groups proceeded with the usual textbook program taught by the regularly assigned teacher. The California Arithmetic Test, Form AA, was administered as a post-test to both groups.

The results show that the experimental group gained considerably more during the period than the control group. The underachievement in the experimental group was cut in half. The control group, on the other hand, was underachieving more at the end of the three-month period. (E - 9 mo., C - 19 mo.). These results seem to indicate that these bright children can be beneficially affected by a good diagnostic and remdial program in mathematics.

Using another technique, a pilot study was made for the purpose of determining the relative effectiveness of the TMI Programmed Text, Multiplication and Division in remediation with selected 5th and 6th grade pupils. The seventy-eight pupils

used in the study were selected from a population of 3 fifth grade and 3 sixth grade classes in one of Albany's public schools located in a low socio-economic census tract. They could do addition and subtraction but were inferior in multiplication and/or division computation as determined by the Brueckner test. Two groups were formed at random; one group used the programmed text (experimental) and the other group used conventional workbooks (control). They spent twenty minutes each day working with these books during the time usually devoted to individual instruction. At the termination of the five month's experiment, both groups had gained significantly in ability to do multiplication and division, but no group was superior to the other.

## Conclusion

From the limited number of research studies mentioned here, one must conclude that that there are far more variables, other than environment, involved in low achievement. No generalizations about the ability of disadvantaged children can be made. However, there are materials which can be created for these students and there are methods of presentation which have proved successful. There is a new approach to teaching the low achiever in mathematics and "inherent in this new approach is the assumption that the low achiever is probably capable of doing better if only the causes of his poor performance can be identified and counteracted."

It would seem that individualized teaching is important. Groups are useful when the students have the same needs. One of the best treatises in this area is a book by Alfred Yates called Grouping in Education. What is noteworthy about this book is the consistency of the research findings about "self fulfilling prophecy"-- that is, expectations determine the outcome.

"Slow learners" and "low achievers" are not synonymous. The things a child brings from his environment are very often the things that cannot be described in words. To any child today "Batman" is more meaningful than Shakespeare. To a child who is not only enclosed in an atmosphere of poverty but who is also conditioned by an intimate society which may frown upon education, any course in mathematics and any presentation of a course in mathematics will not do. Too many of the programs do not take these factors into consideration.

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# "THE NATURE OF COGNITIVE GROWTH"

## BY VERA JOHN

I think I would like to begin by stating that Dr. Bruner's position on cognitive growth and development, at the present time, is the most widely respected and favored approach to the whole question of cognitive growth in children. The preoccupations of Psychologists over the past 30 or 40 years with organisms other than the child has developed into a lack of or breakdown of communications between educators and Psychologists.

The desire for status, scientific respectability and scientific affectiveness has driven most of the people in the field of Psychology to look at organisms which could reveal simplified and more predictable behavior than that which can be elucidated, observed and manipulated in the Psychological Laboratories which work with children. The magnificent thing about children is that very early in their lives they possess an enormous amount of self-directed behavior. This creates a real problem in the traditional design where you attempt to control all variables except one, during the process of an experiment. Thus it is difficult to control internal resistance, curiosity and different approaches to new situations that the child might bring with him to an experimental setting.

I think Bruner has gained the kind of respect he has in the last 10 years in Psychology because he has virtually demanded that the best of behavioral scientists should address themselves to the question of learning and learning in the educational setting. It is sometimes necessary that such a call to duty should come from a University with the reputation of Harvard to counter balance the tradition that has been carrying us in the other direction. It is not surprising that the new Math and Science Programs have also taken root in this kind of collaborative effort that Bruner has developed at Harvard in order to break through the traditional lack of communications that has existed between behavioral scientists and educators. I think this is a very fine beginning but to assume that in the next 10 years we will have developed fundamental principles of broad generalities about learning and learning in a structured setting, and be able to unite as a profession and say yes, indeed this is the way to teach because this is the way children learn, would be a mistake. Indeed the whole concept of what the relationship between teaching and learning is hardly explored or understood. There is some work done on teaching and there's some work done on learning. But the examination of the teaching-learning process as an inter-related phenomena is virtually untouched. If that is the case how can we give systematic commendations for the schools? Now the theoretical approaches which have been more successful in terms of popularity are the ones where teaching as a variable has virtually been eliminated. But one of the reasons why program learning based upon Skinerian principles has become so popular is that you throw away one part of the equation. You program teaching, keep it constant and therefore you only worry about learning. But if teaching is real teaching, it will be a variable, it will vary to some extent from teacher to teacher. And therefore the teaching learning process will have to be looked at in its varied manifestation. But if you program the instruction and you standardize the source of teaching then you are in a better position in a way to look at the learning organism only without having to spend an awful lot of time looking at the interaction. So again this might be a short cut for what we are looking at because it simplifies the immensely complex procedure.

The key issue as far as I am concerned is not; how do we educate individuals who can process more information than their fathers because we have fed information to them more effectively? But how do we educate a generation of children who will

be permanent learners? There are no bodies of current knowledge that are likely to remain unchanged, usable and retrievable in their same form as they are currently taught by the time these children become adults. Unless we teach them how to be active seekers of information who can also process it, code it, store it and retrieve it; we are not preparing them effectively for their future roles. The one thing we have learned about our society is that man must be of a highly adaptive nature if he plans to survive economically and emotionally as society continually accelerates its rate of change. What people have to know is how to seek out the potential element of a situation that is changing and be able to respond to it in an adaptive fashion. This is not only true in the social emotional spheres of life, but also equally true in the area of knowledge. It is the people who have the "flair" for what is coming, who are the successful ones in our society. If we are going to educate children who can really function effectively in our future society then we have to teach them the methods of how you remain permanent learners more than to teach them specifically any content field. Now that does not mean that we don't want to teach them content fields, on the contrary. What it does mean is that we want to teach them everything that we teach them in such a way that they can see what part of knowledge is already established, organized and systematically pulled together. Also what part of knowledge is emerging and how they can participate in discovering the emerging part of knowledge and then respond to it in an adaptive and effective manner. I think it is because of increasing understanding that knowledge is explosive not only in quantity but also in quality in this period of the second part of the 20th century. I feel jobs which are based on manual labor and purely repetitive behavior are likely to be completely extinct by the time the children now in school will be adult workers. It is recognizing these facts that educational innovation is in such a period of constant movement and agitation and so many different ideas are being developed and at times voiced upon the school administrators.

I think Bruner recognizing the need to more fully and fundamentally explore how children learn has developed a theory of the stages of learning partially based on Piaget and partially based on a kind of a Universal sense of what might be going on. Because of this fundamental principal, the crucial things that the growing organism responds to are the recurrent regularities in their environment. These recurrent regularities might be in the very young infant, the fact that there are certain periods of time when the child must be fed, and that the feeding cycle itself has certain recurrent regularities to it. Or recurrent regularities about presence or absence of people and objectives which too can be thought of in some lawful manner. The child will develop adaptations to recurrent regularities in his environment, adaptations which he in a way locks into these recurrent regularities. And the simpler the form of adaptation the greater the locking-in process. Bruner gives the example here in the very young child who has a rattle available to him in his crib. When the rattle disappears the child searches for the rattle by closing and opening his hand by bringing the closed and opened hand up to his face looking at it as if to say is there or isn't there anything in this hand. This motor movement of rattling is tied here with the searching movement of the eyes by means of a combination of these two things which he has developed when he first started to play with the rattle. It is this combination that signals to him that the rattle is gone. He has learned to bring two dimensions of his behavior into some kind of coordinated unit and this coordination is a signal both for absence and presence of the object. This stage of representation of recurrent

regularities in the environment Bruner has called the "enacting schemer", and it's what he feels is the simplest schemer. Particularly when we try to program into our muscles some adaptations to recurrent regularities concerning motor skills. This kind of programming is so fundamental that if a child learns how to ride a bicycle with a bicycle of certain height when he gets the new one which is bigger he has to reprogram the muscle representation of bicycling to adjust to a slightly different object. So again there is already a representation within the body of some of the recurrent regularities of the environment and these representations have to be modified as the external regularities change in some fashion. We have felt the motoric mode of learning is very crucial to a child raised in socially and economically disadvantaged environment. There is one possible important point in relationship to this observation that there are many things one can challenge about it too. There is the variety of physical ability among infants, there is also an important part of just living to which the organism responds without too much external toutering or too much external organization. The world is such that anyone virtually under any conditions of living, unless they are biologically damaged, has their challenge of kind of building into their muscle apparatus some adaptation to recurrent regularities. This part of our life is perhaps more universal than any other, and therefore specific adaptations that are more channeled by people and by the modeling of roles of people is less necessary for this enacting mode of representation. The second level of representation that Bruner speaks of is the iconic one. Namely, the representation of recurrent regularities by some kind of pictorial or image type fashion. Much of what young people have learned through the centuries leading up to the 20th century relied very heavily upon iconic representation. An apprentice standing next to an accomplished craftsman has been trying to replicate a standard, whether the standard was a piece of baked goods or whether a well-built shoe or whether the way in which bricks were put together. The process consisted in observing or seeing an accomplished craftsman working than maintaining some kind of visual imagery of the end product and then trying by means of his own behavior to match that which he was doing to this iconic representation of the final product. We are quite aware that there is a process of internalizing; the final product to which you kind of hold on to might even be imaginable. When your building something at home whether it is an extension to your house or an extension to your boat you have some image of the final product in mind and you match each of your behaviors to this final product which you internally visualize. If asked describe what it is you are trying to build you will have great difficulty in finding appropriate words for it. Why? Because usually what you are trying to do is rather unique. Imagery and iconic representation is particularly useful when searching for a relatively unique solution. Vision is better for uniqueness, language is better for commonalities in universal reoccurances. On the whole we usually teach by means of language. We have paid very little attention to the importance of iconic representation in learning and teaching. We do know that we can capture children better when we interrupt the flow of language which is so easily tuned out by children and adults alike. If we interrupt this flow of language by audio visual aides you bring in another dimension that brings about some greater increase in interest. It switches the subject to another dimension. Again relevant to children raised in low income environment, these children have heard negative language so often used. Like don't do this, don't come here for so many non-pleasurable areas of their life that they are best at tuning out language. They've learned not to listen and are more likely to respond to visual representation. It also is easier for them to pay attention to visual

representations. They don't start after 5 or 10 minutes having their own fantacies and tuning out. You know sitting and listening really is an arduous process and we expose children to it even though we ourselves hate it. So the bringing in of iconic representation is thought of as useful but we haven't really analyzed it very carefully to discover what content areas, what problems and what processes for which this kind of representation or recurrent regularities are most likely to be useful. We know that in teaching sports, movies are often introduced again and again because again you want children to pay close attention to the specifics of how to run, how to jump and how to swim. But as I said much of this is very pragmatic, very imperical. I think teachers might be quite useful in elucidating some basic psychological theory by gathering observations as to what are the content and process areas for which this kind of iconic representation is most useful for.

We seldom gather feedback about the effectiveness of presenting something visually because we test the children again by means of words. What would you get out of this movie we ask? Then we tell children to give us the answers by means of language. So we lose some of the very processes that we are interested in stimulating. Perhaps sketches, pictures, schematic representations of that which they have seen would be a much better feedback device for learning the effectiveness of iconic and visual representations than that of verbal inquiries. Verbal inquiries requires a verbally competent organism. Verbal competent organisms are not the only ones who learn. We have very few ways (other than verbal interaction) in which we can discover something about learning because we have neglected to search and discover. I think men have alot to offer as classroom teachers. I think that there is at least some sexual difference about the reliance upon language as compared to reliance upon visual processes. I think women are indeed the most verbal of the teachers and are reluctant to deal with anything that is either mechanical or visual. Therefore, they overload the children in their charge by limiting learning and teaching to words and don't rely as heavily upon other methods of representation as do their male counterparts. I think that male supervisors might be able to help them at times to expand their somewhat limited verbal horizons. Even though language should not be under-sold and I would be the last one to minimize its role in learning and in teaching. There is nothing as easily to produce as words. Words are indeed cheap. And one of the hardest things I think teachers have to learn is that the best way to defeat the effectiveness of teaching by means of language is by using it indiscriminately When instructing headstart teachers during the last couple of summers the things that I use to tell them, just for two days, the first two days, was try to stop yourself every time you want to talk. Build up a certain tension so that the children are actually expecting you to say something before you actually speak. Discover the many different ways in which you can communicate to them without relying upon language. Headstart teachers had the advantage of having another adult in the classroom. So they could carry out certain instructions as to how to sit, or how to go and lie down for a rest and where to go to the bathroom and so on. These are recurrent regularities again that are very much a part of classroom procedures and therefore they are excellent examples for original teaching. They could do this by mimicrea. They could do this by arrows. They could do this by a variety of non-verbal but visual procedures by means of which the child could be trained and this is what Bruner states-helps to make an effective transition of iconic to symbolic representation.

We should try to make sure that children have some existing internal

representation already before we give language to it. If you take a simple question of what to do at snack time and forgive me if my examples come from the lowest ages in the classroom. You might very well want to be sure that the procedure of washing hands, setting the table, and sitting down to snack time. The sequential procedure which if translated into language is quite complex. It requires at least 3 or 4 phases arranged in sequential order which is usually a longer span of paying attention to language than most low income 4 year olds have. So it makes more sense to first make this process a sequential process, understandable on a non-verbal level before you give it a verbal equivalent. You strengthen one kind of representation whether inactive or iconic before you give it a verbal equivalent because the verbal equivalent event of itself for a verbal immature organism is not going to be a lasting effective source of learning. If you think that just because children learn to talk by the age of 5 or 6 you can teach them by means of language it is a serious mistake. Very often this serious mistake is explained by saying well most of these kinds are born unintelligent anyhow, they cannot learn. It is not that they cannot learn by means of language but they cannot learn because they are not organismatically ready for it. The transition from iconic to symbolic representation then is a very key feature of the educational process. Bruner mentions in his paper illustrating how the age of 5 to 8 is a key age for this transition from iconic to sybolic representation. I think of greater importance really is the concept of this relationship between iconic and symbolic representation. I even have to quarrel a little with the terms because if you follow what I have said before it is quite possible that some highly abstract concepts and processes can be represented iconically. We know that our blueprints and models of all kinds are again and again used in engineering and in the basic physical sciences in Biology and so on. But the question of why do we introduce it, how do we introduce it, how do we make children replicate it, how do we help them then to translate these relationships in one dimension into perhaps another dimension by means of words? This is something that we haven't really explored as systematically either in the classroom or in the Laboratory as the matter really warrants. It's a crucial and fundamental process in learning and in teaching and one of the things that those of you are interested in diagnostic approaches to teaching have again and again said is that there is no match between the way some people teach and some people learn. Some people really have to have a great number of repetitions of exposure in the visual dimension before it really hits home. And if the children are not given a chance to give back that which they have learned and observed in the same modality as they have been taught, but are forced to move over to another modality then they might lose the information either in receiving or in giving back. You never know whether it was a failure in the teaching or it was a lack of effective opportunities for rehearsal. And that is, if you introduce materials which are fundamentally iconic in their nature they are using the illustration of principals or phenomenal by some kind of visual process; what opportunities do your children have in the classroom to rehearse, repeat, store and then retrieve this information in the same modality. What kind of task for monitoring or feeding back their knowledge do we have that is based again on the same dimension. This is very true in the area of reading. You know currently a great amount of emphasis has been put upon the role of pre-school language enrichment which will pay off in reading. I was among the people who have been stressing the tremendous importance of pre-school language instruction particularly for low income children which will have an importance in reading. This is only partially true. Because the amount of language skills any child has, regardless of the background he comes from, and the amount of language he needs to read during the first two years of reading

instruction is really very limited. The kind of vocabulary and syntax you need to read during the first and second grade, unless your an exceptionally good reader, is quite small. So pre-school reading enrichment will only pay off by the fourth and fifth grade because it is there that the active capacity and fluency of the good speaker, will pay off in terms of comprehensive reading. On the other hand it is training in some of the visual relationships between letters that is particularly crucial in the early reading area. And this is where the question of structure comes in; what are structures of a content area at different levels of development? In trying to bring psychological theory to content areas to be acquired in education we sometimes make vague and faulty generalizations. It is true, no one could argue it, that language and reading are inter-related. But how inter-related are they and at what level of learning is the real question of concern to the educator?

Now I have done everything but speak about the real role of language in learning. I think what I'm trying to do is to say that in order to have permanent learners the introduction of language into the learning process of the young child has to be done very thoughtfully. Because you just can't immerse him in a lot of language. On the other hand there isn't enough language interaction in the home of the low income child. On the whole our capacity to educate children in the classroom is still so primitive that most kids get educated very poorly and the reason why we haven't completely fallen down is because some middle class children do get enough compensatory education at home, that they barely squeak into college. And then we have our problems in college because they still don't have skills in organizing material well or orally presenting reports and so on. It is these children who get compensatory (from their middle class home environment) education as contrasted with the low income children, who as yet only get the not very effective group or mass education that we offer to all children. But to come back to the role of language in learning, if we introduce language in learning in a manner other than inundating children with language, we can selectively present to them some language as a response to the child's inquiries. Where first and foremost we develop question-asking organisms instead of verbally effective repeaters. We can then allow the child's questions to be the diagnostic index to what areas of learning they have been able to handle and what areas of learning they have not been able to handle. Therefore our emphasis on the introduction of language is relatively little language from the teacher in many situations. Because this is where you teach to tune out, this is where you teach to undervalue language because it's overly abundant, it doesn't really yield much most of the time and children really learn not to pay attention to it. But if we rely upon language as originating from the child to the teacher instead of the other way around and also utilize a variety of other means of presenting systematically ordered information to children in a classroom, we will then hopefully be relying upon language as a preparation for self regulating organisms for permanent learners. Because I think all of you can remember from your own educational experience, the content matter that you could actively grope with and get social reinforcement for, is that which you retained best, instead of the content matter that was repeatedly thrown to you whether you were awake or not, which you might or might not have paid attention to.

So I'm arguing that let us give language a more crucial role in the educational setting as a developing process, which the child may actively use as an approach to the learning content material. If nothing else have him prepare one question about any unit that he is exposed to, one question that he indeed

prepares independently. Where he gropes with one part of the unit of information given to him. Then let us use our whole series and armaments of newly developed materials which could together with the teachers ability give a verbal answer or response to his question. Indeed let us have tape libraries, let us have record libraries, let us have abundant materials both in the visual and symbolic areas of representation. But which can then help the child to be a self-selecting, self-regulating organism who searches for knowledge instead of suffers it from the mouth of the teacher.

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